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PCT Patent Appln No. CA2003/000309
Title: WIRELESS DEVICE BATTERY CONSERVATION METHOD AND SYSTEM
Inventor(s): HOSSAIN, Asif; ISLAM, Khaledul, M.
Owner: Research In Motion Limited
Our File: PWO-0909

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Dear Sirs

RESPONSE TO WRITTEN OPINION

This is in response to the Written Opinion dated 16 SEP 2004.

IN THE CLAIMS

Please replace pages 15 to 19 containing claims 1 to 34, with enclosed replacement pages 15 to 23, containing claims 1 to 59.

REMARKS

Applicant acknowledges the Written Opinion mailed 16 SEP 2004 and has provided an amendment to the Claims. Original Claims 8, 21, and 22, have been amended to depend from original Claim 3 so as to provide proper antecedents in regard to the first, second, and third level of deep sleep mode. Additional Claims 35 through 59 have been added and include the aspects of original Claim 27 that were deemed novel and inventive in the Written Opinion. For clarity, a complete set of claims has been included for substitution

with the original claims. However, Claims 1-7, 9-20, and 23-34 remain identical to those originally filed.

Applicant notes the references cited in section 1.0 of the Written Opinion mailed 16 SEP 2004 and respectfully disagrees with their relevance as applied by the Examiner.

In section 2.0 of the Written Opinion, the Examiner has objected to subject-matter of Claims 1 and 23 as not being new in the sense of Article 3(2) PCT.

Specifically, in section 2.1 of the Written Opinion, the Examiner contends that document D1 (US-A-5 794 146), in regards to Claim 1, discloses:

> "A method (see fig. 2; fig. 5) for saving power in a deep sleep mode of a mobile device comprising:
> - waking up from the deep sleep mode after a time interval to sample an RF strength of a system (fig.2);
> - comparing the sampled RF condition strength to a predetermined level (col.4, line 60- col.5, line 23; col. 5, lines 53-57);
> - increasing the time interval if the sampled RF condition strength is less than the predetermined level (col. 4, lines 25-26; col. 6, lines 18-28; fig.2)
> - entering the deep sleep mode (fig.2)."

Applicant respectfully disagrees. Specifically, Applicant submits that none of the citations mentioned by the Examiner appear to relate to a deep sleep mode of the mobile device. Rather, the D1 reference relates to acquiring a serving cell and adjusting the scanning process until the serving cell is selected. It is clearly implied that the mobile in D1 is in an active state where D1 rapidly scans for a serving cell and only acts to slow the scan rate when a serving cell is unlikely to be acquired. In D1, it is the slowing of the scan rate, at startup or after the mobile station's serving cell is lost, that purports to reduce battery depletion as scanning is a power intensive process (see D1 at col. 3, lines 27-44). A condition precedent to Applicant's instant invention as claimed in Claim 1 is that the mobile device is within a deep sleep mode. The battery saving measures taught by the present invention of deep sleep mode and specifically the varying levels thereof when combined with an intermittent sampling of RF conditions results in an enhanced power savings not shown or fairly suggested within the D1 reference. Clearly, there is no mention made in the D1 reference of waking up from a deep sleep mode at variable time intervals in order to perform comparison of a sampled RF condition where the variable time interval is increased subject to the comparison results. Thus, Claim 1 is believed novel and inventive.

Similarly, in section 2.2 of the Written Opinion, the Examiner contends that document D1, in regards to Claim 23, discloses:

> "A mobile device battery power saving system, comprising:

-a channel processor (18) for providing a flag signal indicating loss of a system channel (col. 5, lines 24-35 and lines 52-57);
- a deep sleep controller (24) for receiving the flag signal and providing a system lost exit flag;
- a variable setting controller (10) for setting deep sleep mode variables in response to the system lost exit flag and for adjusting the deep sleep mode variables in response to control signals (col.5 lines 24-51); and
- a low power controller (18) for iteratively sampling an RF condition parameter at a time interval defined by the deep sleep mode variables and for providing control signals to the variable setting controller when the RF condition fails to improve (col. 4, lines 48-67)."

Applicant respectfully disagrees. The D1 reference includes a counter (24) that measures the elapsed time spent at a given scan rate in search of a serving cell at startup or when a cell is lost. Applicant respectfully fails to see how the counter (24) may be construed as a deep sleep controller as required by original Claim 23. Further, D1 fails to include any variable setting controller for either setting or adjusting deep sleep mode variables. As mentioned above in regard to Claim 1, the D1 reference is silent on deep sleep mode. As such, D1 further fails to provide any iterative sampling of RF conditions at a time interval defined by the deep sleep mode variables as required by Claim 23. Thus, Claim 23 is believed novel and inventive.

Further, in section 2.3 of the Written Opinion, the Examiner contends that dependent Claims 2-22 and 24-26 do not contain any features that meet the requirements of PCT in regards to novelty and/or inventive step because the technical features of such claims are already known from documents D1-D6 or they are normal design options. Applicant respectfully disagrees and herein incorporates the arguments made above with regard to Claims 1 and 23. As independent Claims 1 and 23 are believed to be novel and inventive, then independent Claims 2-22 and 24-26 dependent therefrom are also believed to be novel and inventive. Should the Examiner believe otherwise, Applicant respectfully requests that the Examiner point out with particularity the claimed aspects of the present invention that are alleged technical features shown in the prior art D1-D6.

In regards to sections 3.0 and 3.1, the Examiner has pointed out features that have been deemed to be novel and inventive. Applicant gratefully acknowledges such indication of novel and inventive subject matter. Applicant has therefore taken the opportunity to present additional claims that incorporate the novel and inventive aspects as indicated by the Examiner. Accordingly, new Claims 35 and 56 each include the cited features not disclosed by D1. Specifically, new Claim 35 now recites:

"A method for saving battery power in a mobile device switched to a deep sleep mode, the method comprising:
a) monitoring a system channel;

b) **counting a number of times the system channel is lost within a timeout period;**

c) **entering the deep sleep mode when the system channel count equals a predetermined number;**

d) waking up from the deep sleep mode after a time interval to sample an RF strength of a system;

e) comparing the sampled RF condition strength to a predetermined level;

f) increasing the time interval if the sampled RF condition strength is less than the predetermined level; and,

g) re-entering the deep sleep mode." (bolding added for emphasis)

As well, new Claim 56 now recites:

"A mobile device battery power saving system, comprising:

a) a channel processor for providing a flag signal indicating loss of a system channel;

b) a deep sleep controller for receiving the flag signal, **counting a number of times the system channel is lost within a timeout period**, and providing a system lost exit flag **for entering a deep sleep mode when the system channel count equals a predetermined number;**

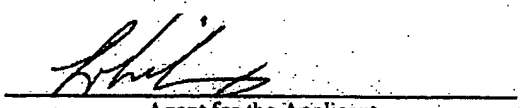
c) a variable setting controller for setting deep sleep mode variables in response to the system lost exit flag and for adjusting the deep sleep mode variables in response to control signals; and,

d) a low power controller for iteratively sampling an RF condition parameter at a time interval defined by the deep sleep mode variables and for providing the control signals to the variable setting controller when the RF condition fails to improve." (bolding added for emphasis)

Each new independent Claim 35 and 56 and the claims dependent therefrom now positively recite the features deemed to be novel and inventive by the Examiner. Thus, Claims 35- 59 are believed novel and inventive.

No new matter has been introduced by way of this amendment to the claims.

Respectfully submitted,



Agent for the Applicant

Encl.
1. Claims 1 to 59

Amended Claims: WO 2004/042941

1. A method for saving battery power in a deep sleep mode of a mobile device comprising:

a) waking up from the deep sleep mode after a time interval to sample an RF strength of a system;

b) comparing the sampled RF condition strength to a predetermined level;

c) increasing the time interval if the sampled RF condition strength is less than the predetermined level; and,

d) entering the deep sleep mode.

2. The method of claim 1, wherein the mobile device enters the deep sleep mode when a channel of the system is lost a predetermined number of times within a timeout period.

3. The method of claim 1, wherein the step of entering the deep sleep mode includes switching the mobile device to one of a first, second and third level deep sleep modes.

4. The method of claim 3, wherein the step of switching includes setting a maximum loop counter value to a predetermined counter value associated with one of the first, second and third level deep sleep modes.

5. The method of claim 4, wherein the step of switching includes setting the time interval to a predetermined time value associated with one of the first, second and third level deep sleep modes.

6. The method of claim 5, wherein the predetermined time value associated with the second level deep sleep mode is greater than the predetermined time value associated with the first level deep sleep mode.

7. The method of claim 6, wherein the predetermined time value associated with the third level deep sleep mode is greater than the predetermined time

value associated with the second level deep sleep mode.

8. The method of claim 3, wherein the step of waking includes determining a system for acquisition from a list of systems associated with one of the first, second and third level deep sleep modes.

9. The method of claim 8, wherein the list of systems includes a first system list, a second system list and a third system list associated with the first, second and third level sleep modes respectively.

10. The method of claim 9, wherein the first system list is a subset of the second system list and the third system list, and the second system list is a subset of the third system list.

11. The method of claim 1, wherein the step of comparing includes comparing the signal to noise ratio of the RF condition to a predetermined value.

12. The method of claim 4, wherein the step of comparing includes setting a mobility flag to true if a Pseudo Noise of the system is unknown.

13. The method of claim 4, wherein the step of comparing includes setting a mobility flag to true or if the mobile device is moving.

14. The method of claim 12, wherein a phase of the Pseudo Noise is monitored for determining mobility of the mobile device.

15. The method of claim 12, wherein the mobile device returns to one of an idle state and the first level deep sleep mode when the mobility flag is true.

16. The method of claim 15, wherein the step of comparing includes

(i) incrementing a loop counter when the mobility flag is false;

(ii) comparing the loop counter value to the maximum loop counter value; and,

(iii) switching the mobile device to one of the second and third level deep sleep modes when the loop counter value equals the maximum loop counter value.

17. The method of claim 16, wherein step (iii) includes switching the mobile device to the second level deep sleep mode when the mobile device is in the first level deep sleep mode.

18. The method of claim 16, wherein step (iii) includes switching the mobile device to the third level deep sleep mode when the mobile device is in the second level deep sleep mode.

19. The method of claim 3, wherein the step of switching includes setting a maximum timeout period to a predetermined timeout value associated with one of the first, second and third level deep sleep modes.

20. The method of claim 19, wherein the step of comparing includes switching the mobile device to one of the second and third level deep sleep modes when the maximum timeout period expires.

21. The method of claim 3, wherein the step of switching the mobile device to one of the second and third level deep sleep modes includes switching the mobile device to the second level sleep mode when the mobile device is in the first level deep sleep mode.

22. The method of claim 3, wherein the step of switching the mobile device to one of the second and third level deep sleep modes includes switching the mobile device to the third level deep sleep mode when the mobile device is in the second level deep sleep mode.

23. A mobile device battery power saving system, comprising:

a) a channel processor for providing a flag signal indicating loss of a system channel;

b) a deep sleep controller for receiving the flag signal and providing a system lost exit flag;

c) a variable setting controller for setting deep sleep mode variables in response to the system lost exit flag and for adjusting the deep sleep mode variables in response to control signals; and,

d) a low power controller for iteratively sampling an RF condition parameter at a time interval defined by the deep sleep mode variables and for providing the control signals to the variable setting controller when the RF condition fails to improve.

24. The mobile device battery power saving system of claim 23, wherein the system channel includes one of a pilot channel and a paging channel.

25. The mobile device battery power saving system of claim 23, wherein the deep sleep mode variables include a timer value for setting the time interval and a loop count value for setting a number of iterations.

26. The mobile device battery power saving system of claim 23, wherein the RF condition parameter includes a signal to noise strength ratio.

27. A method for switching a mobile device to a deep sleep mode comprising:

a) monitoring a system channel;

b) counting a number of times the system channel is lost within a timeout period; and,

c) entering the deep sleep mode when the system channel count equals a predetermined number.

28. The method of claim 27, wherein the step of monitoring includes monitoring one of a pilot channel and a paging channel of the system channel.

29. The method of claim 27, wherein the step of monitoring includes resetting a channel lost counter and a channel lost start time value.

30. The method of claim 29, wherein the step of counting includes incrementing the channel lost counter each time the system channel is lost.

31. The method of claim 30, wherein the step of incrementing includes setting the channel lost start time value to a first current Global Positioning System time when the channel lost counter value is one.

32. The method of claim 31, wherein the step of incrementing includes setting a channel lost end time value to a second current Global Positioning System time when the channel lost counter value has reached the predetermined number.

33. The method of claim 32, wherein the mobile device enters the deep sleep mode when the difference between the channel lost end time value and the channel lost start time value is at least the timeout period.

34. The method of claim 33, wherein the step of entering includes resetting the channel lost counter and the channel lost start time value after the mobile device enters the deep sleep mode.

35. A method for saving battery power in a mobile device switched to a deep sleep mode, the method comprising:

a) monitoring a system channel;

b) counting a number of times the system channel is lost within a timeout period;

c) entering the deep sleep mode when the system channel count equals a predetermined number;

d) waking up from the deep sleep mode after a time interval to sample an RF strength of a system;

e) comparing the sampled RF condition strength to a predetermined level;

f) increasing the time interval if the sampled RF condition strength is less than the predetermined level; and,

g) re-entering the deep sleep mode.

36. The method of claim 35, wherein the step of re-entering the deep sleep mode includes switching the mobile device to one of a first, second and third level deep sleep modes.

37. The method of claim 36, wherein the step of switching includes setting a maximum loop counter value to a predetermined counter value associated with one of the first, second and third level deep sleep modes.

38. The method of claim 37, wherein the step of switching includes setting the time interval to a predetermined time value associated with one of the first, second and third level deep sleep modes.

39. The method of claim 38, wherein the predetermined time value associated with the second level deep sleep mode is greater than the predetermined time value associated with the first level deep sleep mode.

40. The method of claim 39, wherein the predetermined time value associated with the third level deep sleep mode is greater than the predetermined time value associated with the second level deep sleep mode.

41. The method of claim 36, wherein the step of waking includes determining a system for acquisition from a list of systems associated with one of the first, second and third level deep sleep modes.

42. The method of claim 41, wherein the list of systems includes a first system list, a second system list and a third system list associated with the first, second and third level sleep modes respectively.

43. The method of claim 42, wherein the first system list is a subset of the second system list and the third system list, and the second system list is a subset of the third system list.

44. The method of claim 35, wherein the step of comparing includes comparing the signal to noise ratio of the RF condition to a predetermined value.

45. The method of claim 37, wherein the step of comparing includes setting a mobility flag to true if a Pseudo Noise of the system is unknown.

46. The method of claim 37, wherein the step of comparing includes setting a mobility flag to true or if the mobile device is moving.

47. The method of claim 45, wherein a phase of the Pseudo Noise is monitored for determining mobility of the mobile device.

48. The method of claim 45, wherein the mobile device returns to one of an idle state and the first level deep sleep mode when the mobility flag is true.

49. The method of claim 48, wherein the step of comparing includes

(i) incrementing a loop counter when the mobility flag is false;

(ii) comparing the loop counter value to the maximum loop counter value; and,

(iii) switching the mobile device to one of the second and third level deep sleep modes when the loop counter value equals the maximum loop counter value.

50. The method of claim 49, wherein step (iii) includes switching the mobile device to the second level deep sleep mode when the mobile device is in the first level deep sleep mode.

51. The method of claim 49, wherein step (iii) includes switching the mobile device to the third level deep sleep mode when the mobile device is in the second level deep sleep mode.

52. The method of claim 36, wherein the step of switching includes setting a maximum timeout period to a predetermined timeout value associated with one

of the first, second and third level deep sleep modes.

53. The method of claim 52, wherein the step of comparing includes switching the mobile device to one of the second and third level deep sleep modes when the maximum timeout period expires.

54. The method of claim 36, wherein the step of switching the mobile device to one of the second and third level deep sleep modes includes switching the mobile device to the second level sleep mode when the mobile device is in the first level deep sleep mode.

55. The method of claim 36, wherein the step of switching the mobile device to one of the second and third level deep sleep modes includes switching the mobile device to the third level deep sleep mode when the mobile device is in the second level deep sleep mode.

56. A mobile device battery power saving system, comprising:

a) a channel processor for providing a flag signal indicating loss of a system channel;

b) a deep sleep controller for receiving the flag signal, counting a number of times the system channel is lost within a timeout period, and providing a system lost exit flag for entering a deep sleep mode when the system channel count equals a predetermined number;

c) a variable setting controller for setting deep sleep mode variables in response to the system lost exit flag and for adjusting the deep sleep mode variables in response to control signals; and,

d) a low power controller for iteratively sampling an RF condition parameter at a time interval defined by the deep sleep mode variables and for providing the control signals to the variable setting controller when the RF condition fails to improve.

57. The mobile device battery power saving system of claim 23, wherein the system channel includes one of a pilot channel and a paging channel.

58. The mobile device battery power saving system of claim 23, wherein the deep sleep mode variables include a timer value for setting the time interval and a loop count value for setting a number of iterations.

59. The mobile device battery power saving system of claim 23, wherein the RF condition parameter includes a signal to noise strength ratio.